Journal of Forensic and Legal Medicine 25 (2014) 26–29

Contents lists available at ScienceDirect

Journal of Forensic and Legal Medicine

journal homepage: www.elsevier.com/locate/jflm

Original communication

Pattern of acute poisonings in children below 15 years – A study from Mangalore, South India

Pradhum Ram [a], Tanuj Kanchan [b,*], B. Unnikrishnan [c]

[a] Kasturba Medical College, Mangalore, Manipal University, India
[b] Department of Forensic Medicine, Kasturba Medical College, Mangalore, Manipal University, India
[c] Department of Community Medicine, Kasturba Medical College, Mangalore, Manipal University, India

ARTICLE INFO

Article history:
Received 28 January 2014
Received in revised form
1 April 2014
Accepted 15 April 2014
Available online 26 April 2014

Keywords:
Acute poisonings
Children
Mortality and morbidity
South India

ABSTRACT

Acute poisoning in children is a problem ubiquitous in distribution and is an important paediatric emergency. The present research was aimed to study the pattern and outcome of childhood poisoning under the age of 15 years at a tertiary care centre in South India to characterize the problem of acute paediatric poisoning among the children in different age group in the region. Medical records of all poisoning patients admitted during 2010 and 2011 were reviewed, and the information relating to the sociodemographic and clinical profile of the patients was recorded. Acute poisoning was reported in 81 children aged below 15 years during the study period. 50.6% were boys ($n = 41$) and 49.4% girls ($n = 40$). The mean age of the study sample was 6.8 years. Mean age was observed to be higher in females than males. The maximum number of cases were observed in the below 5 years age group ($n = 45$). A male predominance was evident in the below 5 years age group, while a female predominance in the age group between 10 and 15 years. Kerosene ($n = 23$, 28.4%) and organophosphate compounds ($n = 16$, 19.8%) were the most common agents responsible for poisoning in children. The majority of the poisoning cases were reported to the hospital within 12 h of the incident ($n = 65$, 83.3%). The mortality in paediatric poisoning was observed to be 7.4%. The majority of the children ($n = 68$, 84.0%) recovered, while seven patients had left the hospital against medical advice (8.6%). The study reports agrochemicals and hydrocarbons to be the most commonly implicated agents in paediatric poisoning. The cause of paediatric poisonings varies in different age groups and hence, preventive strategies should be planned accordingly.

1. Introduction

Poisoning is a term used to describe the event where-in cells are injured or destroyed by inhalation, ingestion, injection or absorption of a toxic substance.[1] Acute poisoning is one of the leading causes of morbidity and mortality worldwide and hence, a serious health concern.[2] Acute poisoning in children is a problem ubiquitous in distribution and is an important paediatric emergency. In a report published by the WHO, 13% of the total poisoning cases were reported among the paediatric and adolescent age groups.[1]

All cases where the attending doctor considers the need for further investigations by the law enforcement agencies are termed as medicolegal cases (MLC). These cases are dealt in accordance with the laws of the land and as per the directives issued by the health departments. In India, all poisoning cases are considered as medicolegal cases irrespective of the circumstances and nature of poisoning. Owing to the large number of poisonings reported in India, these cases form the major part of the medicolegal cases brought to the hospitals.

Depending upon the local customs and beliefs, demography, socio-economic status of the area and education level amongst others, the cause and types of poisoning vary in different parts of the world. Besides, the pattern of poisonings may vary with respect to age and sex of the individuals. Though published data are available on fatal poisonings in the region,[2–5] none is available on the subject of acute paediatric poisonings which are mostly unintentional, and are rarely known to result in a fatality. Hence, the present research was designed to study the pattern and outcome of childhood poisoning under the age of 15 years at a tertiary care centre in Mangalore, South India, and thus, to characterize the problem of acute paediatric poisoning among the children in different age group in the region.

* Corresponding author. Tel.: +91 9448252394 (mobile).
E-mail addresses: tanujkanchan@gmail.com, tanujkanchan@yahoo.co.in, tanuj.kanchan@manipal.edu (T. Kanchan).

http://dx.doi.org/10.1016/j.jflm.2014.04.001
1752-928X/

2. Materials and methods

The present registry-based retrospective research was carried out at the Government District Wenlock Hospital (GDWH), Mangalore, which is a tertiary care hospital and a referral centre for whole of coastal Karnataka in South India.[6] Medical records of all poisoning patients admitted to the GDWH hospital from January, 2010 to December, 2011 were reviewed, and the information relating to the socio-demographic and clinical profile of the patients was recorded. Paediatric cases of food poisoning, adverse reaction to prescribed drugs, and snakebites were not included in the study. The information obtained from the medical records included the age and gender of the child, poison consumed, circumstances, time and month of poison consumption, duration of hospital stay, and the outcome in terms of recovery and mortality.

The paediatric cases were classified as children aged 5 years and less (infants, toddlers, and preschool children), those aged between 5 and 10 years (school age children), and between 10 and 15 years (older children in their early adolescence).[7–9] The ages were classified broadly into three groups for comparative analyses to find out the problem status in each age group. Mangalore is a coastal city with a tropical monsoon climate. For studying the seasonal variations, the seasons were classified as summer (February to May), rainy (June to September), and winters (October to January).[2] The information obtained was analysed using SPSS (Statistical Package for Social Sciences) version 11.5, and the results were expressed in proportions.

3. Results

Acute poisoning was reported in 81 children aged below 15 years during the study period. Of the total acute poisoning cases, 50.6% were males ($n = 41$) and 49.4% females ($n = 40$). The mean age ± SD was observed to be 6.8 ± 5.6 years. Mean age was observed to be higher in females (8.7 ± 5.5 years) than males (5.0 ± 5.1 years). Age distribution of the cases is shown in Fig. 1. Among the three age groups, the maximum number of cases were observed in the below 5 years age group ($n = 45$). A male predominance was evident in the below 5 years age group, while a female predominance in the age group between 10 and 15 years (Table 1).

Table 1
Age and sex distribution of cases.

	Male (%)	Female (%)	Total (%)	Male:Female
≤5 years	30 (66.6)	15 (33.3)	45 (100)	2:1
5–10 years	00 (–)	05 (100)	05 (100)	–
>10–15 years	11 (35.4)	20 (64.6)	31 (100)	1:1.8
Total	41 (100)	40 (100)	81 (100)	1:1

Kerosene ($n = 23$, 28.4%) and organophosphate compounds ($n = 16$, 19.8%) were the most common agents responsible for causing poisoning in children. Overall, agrochemicals and hydrocarbons were the most commonly implicated agents in paediatric poisoning. The details of the agents reported as the cause of paediatric poisoning among the three age groups are shown in Table 2. It is observed that organophosphates were most commonly implicated in 10–15 years age group ($n = 09$, 29.0%) while kerosene was most common cause of poisoning in children aged below 5 years ($n = 21$, 46.7%).

The circumstances of poisoning were mentioned only in 35 cases (43.2%). The manner was accordingly designated as accidental ($n = 23$), suicidal ($n = 11$) and homicidal ($n = 1$) in these cases. A larger proportion of the children consumed poisonous agents in the afternoon hours ($n = 29$). On further observing the time of consumption among the different age groups, it is observed that a larger number of older children consumed poison during morning ($n = 11$) and evening ($n = 09$) hours (Table 3). Maximum number of poisoning cases were observed during the months of May ($n = 22$) and August ($n = 11$). Monthly distribution of cases is shown in Fig. 2. A larger proportion of cases were reported during summers in the children aged below 5 years, while among the older children poisoning more commonly occurred during the rainy season (Table 4).

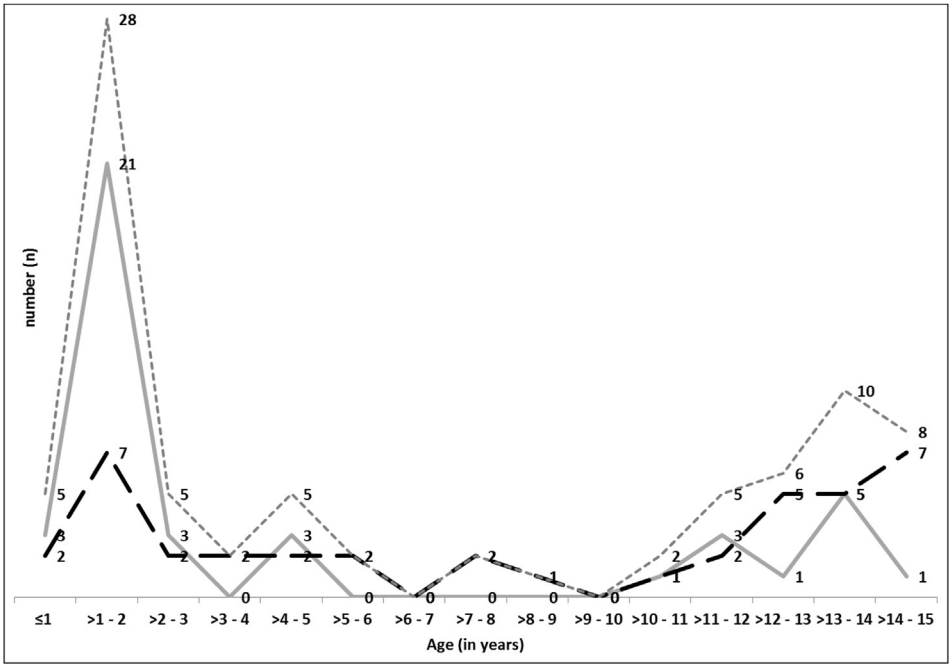

Fig. 1. Age distribution of cases.

Table 2
Agents causing poisoning in children.

Agent	*N* (%)	≤5 years (%)	5–10 years (%)	>10–15 years (%)
Insecticides				
i Organophosphates	16 (19.8)	07 (15.6)	–	09 (29.0)
ii Paraquat	02 (02.5)	–	–	02 (06.5)
iii Pyrethroid	01 (01.2)	–	–	01 (03.2)
Rodenticides	12 (14.8)	06 (13.3)	–	06 (19.4)
Hydrocarbons				
i Kerosene	23 (28.4)	21 (46.7)	–	02 (06.5)
ii Diesel	02 (02.5)	02 (04.4)	–	–
Corrosive substances	12 (14.8)	03 (06.7)	02 (40.0)	07 (22.6)
Medicinal agents	06 (07.4)	03 (06.7)	–	03 (09.7)
Others	03 (03.7)	03 (06.7)	–	–
Unknown	04 (04.9)	–	03 (60.0)	01 (03.2)
Total	81 (100.0)	45 (100.0)	05 (100.0)	31 (100.0)

Table 3
Time of consumption of poisonous agents among children.

Time	*N* (%)	≤5 years (%)	5–10 years (%)	>10–15 years (%)
Morning (6 am–12 pm)	23 (31.5)	10 (13.7)	02 (2.7)	11 (15.1)
Afternoon (12 pm–6 pm)	29 (39.7)	21 (28.8)	02 (2.7)	06 (8.2)
Evening (6 pm–12 am)	18 (24.7)	09 (12.35)	–	09 (12.35)
Night (12 am–6 am)	03 (4.1)	01 (1.4)	–	02 (2.7)
Total	73 (100)	41 (100)	05 (100)	27 (100)

Time of consumption was not reported in 8 cases.

The majority of the poisoning cases were reported to the hospital within 12 h of the incident ($n = 65$, 83.3%). With regards to the time lapse between the incident of poisoning and hospitalization, maximum delay in admission was reported to be 4 days. Mean delay in hospital admission was found to be 10.0 ± 18.3 h. In terms of the outcome, the majority of the children ($n = 68$, 84.0%) recovered. During the study period, six patients (7.4%) died, while seven patients had left the hospital against medical advice (8.6%). The mortality in paediatric poisoning was thus, observed to be 7.4%. The duration of hospitalization in these cases ranged between 1 and 16 days, mead duration of hospitalization being 4.8 ± 3.0 days.

For the fatal cases reported during the study period ($n = 6$), all the victim were females, and except for one child aged 2 years who died of kerosene poisoning, others ($n = 5$) were aged between 14 and 15 years. These older children had died of Paraquat and Copper Sulphate poisoning.

4. Discussion

Medicolegal cases (MLC) are frequently encountered in the practice of medicine, and poisoning forms the major part of the medicolegal cases. The role of a medical practitioner in a suspected case of poisoning is well-defined. While the primary duty of a medical practitioner is to save the life of the patient, he in addition is expected to discharge legal duties as well. These legal duties include intimation to the police, and preservation of evidentiary material such as the clothing, vomitus if any, stomach wash, and blood and urine samples. In case of the death of an individual due to suspected poisoning, death certificate is not issued. Autopsy is mandatory in fatal cases, and the relevant viscera is preserved and sent for chemical analysis at the Regional Forensic Science Laboratories (RFSL). Various sections in the Indian Penal Code (IPC) deal with the medicolegal aspects of poisoning. These sections describe the offences relating to handling and administration of poisonous substances and the punishment for any violations. Besides, in reference to medical practitioners, any violation in performing their legal duties is liable to attract punishment under relevant sections of the IPC.

Children are known to be curious about their surroundings and are unaware of the impending danger.[1] The proportion of male to female cases of poisoning during the study period was found to be largely similar. The ingestion of the poisonous substance was predominantly accidental thereby subjecting the paediatric male and female to an equal chance of poisoning. The natural instinct of a young child predisposes the child to explore the surrounding environment, and place objects found into its mouth and thus resulting in unintentional poisonings.[1] It is suggested that young boys tend to be more active than girls, which makes it more likely that they will injure themselves.[10] An interesting observation in this regard was the reversal of sex ratios in the below 5 years age group (male: female = 2:1) and in the age group between 10 and 15 years (male: female = 1:1.8). The mean age was observed to be higher in females (8.7 years) than males (5.0 years). The information regarding the poison consumed, and the manner of poisoning as mentioned in hospital records in the study region is usually based on the history provided by the accompanying relatives or police personnel. Sometimes the containers or the agent that has been consumed is brought at the time of hospital admission or later during the course of hospital stay.[11] The majority of the cases wherein the circumstances surrounding the event were documented in the case records were observed to be of unintentional

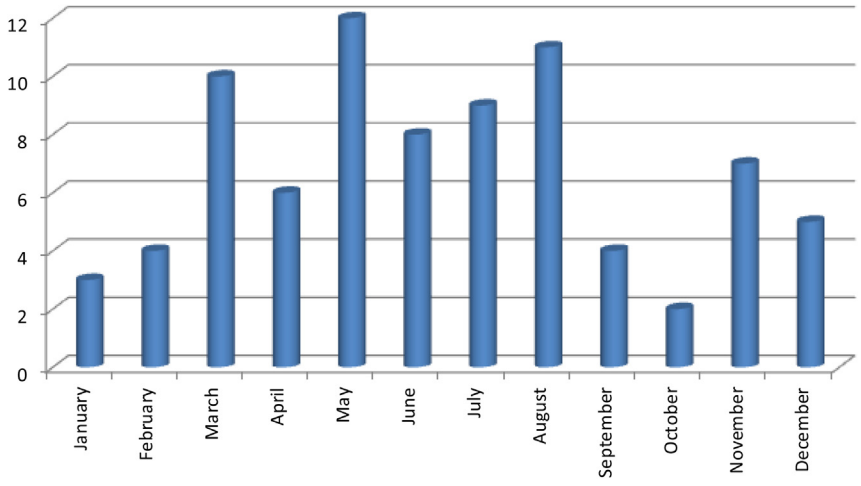

Fig. 2. Monthly distribution of cases.

Table 4
Seasonal variations of the reported cases.

Time	*N* (%)	≤5 years (%)	5–10 years (%)	>10–15 years (%)
Summers	32 (39.5)	21 (25.9)	–	11 (13.6)
Rainy	32 (39.5)	14 (17.3)	03 (3.7)	15 (18.5)
Winters	17 (21)	10 (12.3)	02 (2.5)	05 (6.2)
Total	81 (100)	45 (55.6)	05 (6.1)	31 (38.3)

poisoning. Our observations on the age, sex and manner of poisoning were similar to that documented in a number of studies worldwide.[12–15]

In the present investigation, kerosene and organophosphate compounds were the most common agents responsible for causing poisoning in children. Studies conducted in India,[16] Pakistan,[17] Nepal[18] and Nigeria[19,20] yielded similar results whereas in studies conducted in Trinidad, Turkey and Iran[13–15] other agents such as poisoning due to medication over-dose was found to be the most common cause. In and around the Indian peninsula this pattern of poisoning as observed in our study can be attributed to the frequent use of kerosene for domestic needs, thereby implying its easy availability in the household. Ingestion remains the most common route of poisoning. According to the World report on child injury prevention,[1] the common agents of poisoning in low-income and middle-income areas such as the one under study are fuels such as paraffin and kerosene, pharmaceuticals and cleaning agents. Most of the paediatric poisonings in the neighbouring country of Nepal were reported in the home setting and involved exposure to only a single substance[18] which is similar to that observed in the present research.

In terms of the outcome, the majority of the children recovered which can be attributed to the fact that most of these cases were reported to the hospital promptly within 12 h of the incident. During the study period, the mortality in paediatric poisoning was observed to be 7.4%. Similar studies conducted in various parts of the globe[16–20] have reported mortality rates ranging from 0.4%[14] to 13%[18] in Turkey and Nepal respectively. For the fatal cases reported during the study period, all except for one child aged 2 years were aged between 14 and 15 years. This probably implies that quantities ingested in the younger age groups were minimal and that these poisonings were primarily accidental in nature. Contrastingly higher fatalities in the older children can be thought of due to intentional self-harm and ingestion of high doses. Studies in the past have shown poisoning as one of the preferred method of committing suicides in the region and worldwide.[21,22] The rate of fatal poisoning is reported to be maximal for children under one year, with another slight peak around 15 years.[1]

Data on morbidity and mortality related to poisoning among children in India is limited and hence, the present study may be a useful addition to the literature on paediatric poisoning. Limitations however exist in the study, and arise primarily from the fact that this is a retrospective study. The identification of the paediatric poisoning cases and the manner of poisonings were based on the history provided by the children and the relatives. Information on the quantity consumed and reasons for the suicidal and homicidal poisonings were not recorded either. Unintentional poisoning in children is largely preventable. The study reports agrochemicals and hydrocarbons to be the most commonly implicated agents in paediatric poisoning. The cause of paediatric poisonings varies in different age groups and hence, preventive strategies should be planned accordingly. Our approach to the study reveals that similar prospective studies need to be planned to understand the magnitude and problem status of paediatric poisoning in the region.

Ethical approval
None declared.

Funding
No support in form of grants.

Conflict of interest statement
The authors have no conflict of interest to declare.

References

1. Children and poisoning. Available at: http://www.who.int/violence_injury_prevention/child/injury/world_report/Poisoning_english.pdf [accessed on 24.10.13].
2. Kanchan T, Menezes RG, Kumar TS, Bakkannavar SM, Bukelo MJ, Sharma PS, et al. Toxicoepidemiology of fatal poisonings in Southern India. *J Forensic Leg Med* 2010;**17**(6):344–7.
3. Kumar TS, Kanchan T, Yoganarasimha K, Kumar GP. Profile of unnatural deaths in Manipal, Southern India 1994–2004. *J Clin Forensic Med* 2006;**13**(3):117–20.
4. Shetty BSK, Kanchan T, Menezes RG, Shetty M, Arun M, Salian PV, et al. Poisoning fatalities in Mangalore, South India: a three year snapshot. *Int J AJ Inst Med Sci* 2012;**1**:104–11.
5. Kanchan T, Menezes RG. Suicidal poisoning in Southern India: gender differences. *J Forensic Leg Med* 2008;**15**(1):7–14.
6. Kumar N, Kanchan T, Unnikrishnan B, Rekha T, Mithra P, Venugopal A, et al. Clinico-epidemiological profile of burn patients admitted in a tertiary care hospital in coastal South India. *J Burn Care Res* 2012;**33**(5):660–7.
7. Kanchan T, Menezes RG. Mortalities among children and adolescents in Manipal, southern India. *J Trauma* 2008;**64**(6):1600–7.
8. Kanchan T, Menezes RG, Monteiro FN. Fatal unintentional injuries among young children-a hospital based retrospective analysis. *J Forensic Leg Med* 2009;**16**(6):307–11.
9. Early and late adolescence. Available at: http://www.unicef.org/sowc2011/pdfs/Early-and-late-adolescence.pdf [accessed on 23.08.13).
10. Zhou B, Zhou X, Ouyang LZ, Huang XY, Zhang PH, Zhang MH, et al. An epidemiological analysis of paediatric burns in urban and rural areas in south central China. *Burns* 2014;**40**(1):150–6.
11. Singh B, Unnikrishnan B. A profile of acute poisoning at Mangalore (South India). *J Clin Forensic Med* 2006;**13**(3):112–6.
12. Oprescu F, Peek-Asa C, Wallis A, Young T, Nour D, Chereches RM. Pediatric poisonings and risk markers for hospital admission in a major emergency department in Romania. *Matern Child Health J* 2012;**16**:495–500.
13. Ansari-Moghaddam A, Martiniuk AL, Mohammadi M, Rad M, Sargazi F, Sheykhzadeh K, et al. The pattern of injury and poisoning in South East Iran. *BMC Int Health Hum Rights* 2012;**10**(12):17.
14. Andiran N, Sarikayalar F. Pattern of acute poisonings in childhood in Ankara: what has changed in twenty years? *J Pediatr* 2004;**46**(2):147–52.
15. Pillai GK, Boland K, Jagdeo S, Persad K. Acute poisoning in children. Cases hospitalized during a three-year period in Trinidad. *West Indian Med J* 2004;**53**(1):50–4.
16. Rathore S, Verma AK, Pandey A, Kumar S. Pediatric poisoning trend in Lucknow district, India. *J Forensic Res* 2013;**4**:179.
17. Hamid MH, Butt T, Baloch GR, Maqbool S. Acute poisoning in children. *J Coll Physicians Surg Pak* 2005;**15**:805–8.
18. Budhathoki S, Poudel P, Shah D, Bhatta NK, Dutta AK, Shah GS, et al. Clinical profile and outcome of children presenting with poisoning or intoxication: a hospital based study. *Nepal Med Coll J* 2009;**11**:170–5.
19. Adejuyigbe EA, Onayade AA, Senbanjo IO, Oseni SE. Childhood poisoning at the Obafemi Awolowo University Teaching hospital, Ile-Ife, Nigeria. *Niger J Med* 2002;**11**:183–6.
20. Oguche S, Bukbuk DN, Watila IM. Pattern of hospital admissions of children with poisoning in the Sudano-Sahelian North eastern Nigeria. *Niger J Clin Pract* 2007;**10**:111–5.
21. Kanchan T, Menon A, Menezes RG. Methods of choice in completed suicides: gender differences and review of literature. *J Forensic Sci* 2009;**54**(4):938–42.
22. Subba SH, Binu VS, Menezes RG, Kanchan T, Arun M, Patil R, et al. Pattern and trend of deliberate self-harm in western Nepal. *J Forensic Sci* 2009;**54**(3):704–7.